BLACKLEAF ENVIRONMENTAL IMPACT STATEMENT

A REPORT ON AIR QUALITY AND NOISE

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BLACKLEAF FIELD DEVELOPMENT EIS

Technical Report on Climate, Air Quality and Noise

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SUMMARY

Impacts to the climate from drilling operations discussed in the Blackleaf Environmental Impact Study area would not be measurable; however, climatic factors must be considered in planning the proposed operations. These considerations include the placement of roads for ease of maintenance and the pumping dry of reserve pits to ensure adequate drying.

Impacts to the air quality of the area from exploratory drilling operations would be minimal and temporary. Drilling engine exhaust and dust pollutants would be at a maximum only during the 4 to 6-month drilling season and would return to predrilling levels after the abandonment or completion of the proposed test wells.

The risk, although minimal, does exist for a hydrogen sulfide (H_2S) blowout/breakout at proposed wellsites. Under worst possible meteorological conditions, and in an extreme H_2S blowout case, H_2S concentrations could build up to a point (15 ppm) that throat and eye irritation could result in the immediate area. Current procedures to monitor and control H_2S during drilling in H_2S zones coupled with requirements for blowout prevention equipment, would reduce this risk considerably. The risk of a production pipeline rupture is extremely small, and the line would be immediately shut down if a rupture were to occur.

Odors related to field development in the area would be noticeable to recreationists in the area and could be reduced if provisions for tank battery vapor recovery systems were implemented and all flaring/venting were to be disallowed.

All sites in this area have good potential to disperse pollutants, and with the above mitigations, both exploratory and production air quality impacts would be insignificant.

Noise impacts from a single exploratory well and access road could result in a quarter to one-half mile influence zone around the drilling rig and access road. These noise levels could impact wildlife and recreational users in these influence zones.

Noise impacts from a drilling well would be temporary. Access and noise levels would be at their peak during the drilling phase, but would decrease after drilling. Noise impacts during production would be primarily from maintenance traffic to the wellsite. Mitigations, such as limiting visits during critical wildlife periods, could be imposed to reduce or eliminate these impacts, if necessary, as determined by Bureau and Forest Service wildlife experts.

INTRODUCTION

The report was written as a supplement for the Blackleaf Environmental Impact Statement (EIS). The EIS addresses the impacts of proposed field drilling and development operations in the Rocky Mountain Front area (figure 1) on federal mineral estate.

This report presents a general description of the climate in the study area, a discussion of potential impacts of federal minerals exploratory operations and field development on air quality, and a discussion of noise impacts related to these operations. These impacts are common to all the EIS alternatives. The report also analyzes impacts by the alternatives developed by the EIS team.

Baseline data concerning the area is presented with a quantitative discussion of the magnitude of impacts. Qualitative conclusions are described and incorporated into potential mitigating measures.

This report relies on USGS Open File Report 81-859 for generic air quality and noise data (see references). This report does not address the impacts of oil and gas development on state or fee mineral estate.

CLIMATE

The study area is located in the central and north-central climatological subdivisions of Montana. The area contains a plains ecosystem to the east and sharp elevation rises associated with the Rocky Mountain Front to the west. The area is characterized by low and highly variable precipitation, low relative humidity, abundant sunshine, and moderate temperatures with large diurnal and annual ranges. Summers are short and cool, and winters long and often severe. As a result of the abundant sunshine received on southerly slopes and low precipitation, the majority of timber growth occurs on north-facing slopes. North-facing slopes retain more of the moisture from the winter snowpack than those with southern exposure (National Oceanic and Atmospheric Administration, 1960). Due to persistent high winds (15-25 mph), many trees are wind- pruned to the west.

The climate on the lower slopes of the area is in the semiarid, middle latitude steppe. The upper slopes (which are at tree-line and characterized by a heavy winter snowpack) can be considered to be in the mountain (highland) climate. Frequent mountain-generated thunderstorms and heavy showers occur in the area.

The climate of the study area is similar to that of Augusta, Montana.

The average monthly temperature for Augusta in July is approximately 65.5°F, and 22.3°F for January, with an annual average of 43.2°F.

The average growing season of Augusta is 104 days, and will be slightly less (±90 days) in the study area due to altitude changes.

Wind is a major environmental factor in the area. Winds are steady at an annual average of 15 mph with a predominately west to east movement. Timber in the area is wind-pruned and sculptured in the direction of the west to east prevailing winds.

Foehn winds are common in winter storms, resulting in rapid temperature oscillations with extreme 70 to 100 mph gusts in winter and spring. Air mass inversions are rare.

CONCLUSIONS

The impact of oil and gas operations in the Blackleaf Area on climate will not be measurable. However, the following climatic considerations should be made in site selection, road construction, and rehabilitation:

Site Selection:

1. Sites should be located out of identified flood hazard areas.

2. Sites should be located out of identified avalanche tracks. (A USFS-approved avalanche control program may be required at sites located in unstable snowpack areas.)

Road Construction:

1. Roads should avoid "dugways" and other snow accumulation (drift) areas that would make winter road maintenance difficult, or spring reopening of roads difficult.

2. Roads should be located with south exposures when possible, so that snowmelt and road dryout would occur early in spring.

3. Culverts and bridges should be designed to accommodate at least a 25-year storm.

4. Roads should not be located in recognized flood hazard areas or identified avalanche tracks.

Rehabilitation:

1. Reserve pits should be pumped dry at the conclusion of operations, as the combination of high precipitation (including snowfall), cool temperatures and low evaporation, may not permit proper drying. Drilling muds should be removed to approved disposal sites.

2. USFS and BLM recommended seeds for revegetations should be utilized. Seeds should be selected for optimum growth, given the short growing season, to facilitate rapid vegetation of the disturbed areas.

AIR QUALITY

General Characteristics

Impacts to the air quality of the study area will vary from minor to moderate impacts. The type, extent, area, and mitigations placed on oil/gas development are important factors for determining the severity of air quality degradation resulting from field development.

The study area can be divided into two broad categories: the upper bench areas and ridges, and the plains and canyon mouth areas. The upper benches and ridges have good potential to disperse any pollutants as they are more exposed to upper level prevailing winds, and are above any inversion levels.

The prairie and canyon mouth areas have less potential for dispersion of pollutants due to lower wind speeds and potential inversions.

Governing Regulations and Existing Air Quality

The Clean Air Act of 1970 (as amended in 1977) established standards for seven categories of pollutants (total suspended particulates (TSP), sulfur dioxide, nitrogen oxides, hydrocarbons, ozone, and lead). The National Ambient Air Quality Standards (NAAQS), and the Montana Ambient Air Quality Standards, and their maximum acceptable levels are listed in Table 1. The Montana Ambient Air Quality Standards are generally stricter than the National Standards.

Table 1. National Ambient Air Quality Standards (NAAQS)

(Source: Federal Register 36, no. 84, part II, April 30, 1971, p. 8186-8201)

(Note: Standards, other than those based on annual average or annual geometric average, are not to be exceeded more than one a year.)

Pollutant	Averaging Time	Primary standard	Montana standard	Federal Secondary standard	Measurement method
Carbon monoxide	8 hr	10 mg/m^3 (9 ppm)	10 mg/m^3 (9 ppm)	Same	Nondispersive infrared spectroscopy
	1 hr	40 mg/m^3 (35 ppm)	23 ppm	40 mg/m^3 (35 ppm)	Nondispersive infrared spectroscopy
Nitrogen Dioxide	Annual average	100 ug/m^3 (0.05 ppm)	100 ug/m^3 (0.05 ppm)	Same	Colorimetric using NaOH
Hydrogen Sulfide	none	none	.03 ppm		Methylene blue spectrophotometric
Sulfur dioxide	Annual average	80 ug/m^3 (0.03 ppm)	.02 ppm	80 ug/m^3 (0.03 ppm)	Pararosaniline method
	24 hr	365 ug/m^3 (0.14 ppm)	.10 ppm		Pararosaniline method
	3 hr			1,300 ug/m^3 (0.5 ppm)	Pararosaniline method
Lead	Annual average	1.5 ug/m^3	1.5 ug/m^3		
Suspended Particulate Matter	Annual geometric mean	75 ug/m^3	75 ug/m^3	60 ug/m^3	High-volume sampling
	24 hr	260 ug/m^3	200 ug/m^3	150 ug/m^3	High-volume sampling
Hydrocarbons (corrected for methane)	3 hr (6-9 a.m.)	160 ug/m^3 (0.24 ppm)	none	160 ug/m^3 (0.24 ppm)	Flame ionization detector using gas chromatology
Photo-chemical oxidants	1 hr	240 ug/m^3 (0.12 ppm)	none	240 ug/m^3 (0.12 ppm)	Chemiluminescent method

Background levels for the criteria pollutants in Table 1 are not available. There are no long-term representative sampling stations near, or upwind of the study area. The only air quality data gathered for this area was at the Circle 8 Ranch for the year of 1985 only. This data supports the conclusion that due to the site's areal remoteness from pollutant sources that its air quality is excellent.

There have been reports of winter haze in the Blackleaf area, particularly during winter cold episodes. It is probable that the haze results from pollutants produced by wood-burning stoves during times of cold, subsiding, high pressure air masses with strong surface inversions. These inversions are rare, but when they occur they tend to trap and accumulate the smoke from stoves.

In addition to the NAAQS and State of Montana Ambient Air Quality Standards discussed above, the Clean Air Act Amendments of 1977 established Prevention of Significant Deterioration (PSD) standards for areas classified as either Class I, Class II, or Class III. These classifications were established to protect relatively pristine areas (Class I), and the areas already moderately impacted by pollutants (Class II) from further degradation. Presently, no Class III areas have been identified. The entire Blackleaf area is in a Class II area. This means that any increase in pollutant concentrations over the existing values shall be limited to the values presented in Table 2. The study area is bordered upwind by mandatory Class I area (the Bob Marshall Wilderness).

Table 2. Maximum Allowable Increments of Deterioration, Measured in Micrograms Per Cubic Meter

(Source: Clean Air Act Amendments of 1977)

Pollutant	Class I	Class II
Particulate matter:		
Annual geometric mean	5	19
24-hour maximum	10	37
Sulfur dioxide		
Annual arithmetic mean	2	20
24-hour maximum*	5	91
3-hour maximum*	25	512

*Maximum allowable increment may be exceeded once per year at any receptor site.

A designated responsible agency is required to review for compliance with PSD standards if any pollutant source is demonstrated to produce more than 250 ton/year of any one pollutant as listed in the NAAQS (If the pollutant is not listed in Table 2, the NAAQS will be taken as the present PSD standard).

As stated previously, baseline data on existing air quality in the area is limited. However, the air quality of the area is probably very good and there are no permitted PSD sources in, or upwind of, the study area.

POTENTIAL POLLUTANT SOURCES

With a magnitude dependent on the oil and gas development alternative selected, air quality degradation to the study area would occur as a result of the following pollutant emissions if oil and gas development were to occur:

1. Exhaust from drilling rig engines.

2. Exhaust from vehicular travel to and from the site.

3. Fugitive dust from traffic on access roads.

4. Gases encountered during drilling operations which could be released through the mud system.

5. Emissions from producing wellsite processing facilities (heater/ treaters, tanks, flares, etc.)

6. Emissions from possible additional hydrocarbon processing plants and/or H_2S sweetening plants established in the event of field production.

7. Emissions from possible pipeline ruptures.

1. Exhaust From Drilling Rig Engines

Engines used on drill rigs in the Overthrust Belt are primarily a diesel electric 3-engine type. (Direct drive diesels are utilized in some cases, usualy on more shallow holes. This type utilizes smaller engines that may pollute less, but the additional light plant required would make this setup equivalent in emissions to diesel-electric.) If an Electro Motive Division of General Motors Corporation Engine Model 12-645EI were utilized at full capacity, the exhaust constituents would be as indicated in Table 3. Also indicated for comparative purposes are approximate emissions from a heavy duty diesel truck/bus at 60 mph operation:

Table 3. Exhaust Constituents of GMC Engine Model 12-645EI

(Source: General Motors, Electro Motor Division, June 12, 1980)

	Full capacity operation	Diesel truck/bus at 60 mph*
	Engine model 8-645E	
Rated output brake horsepower	1,100	300
Rated engine speed (rpm)	900	3500
Nominal fuel rate (lbs/hour)	440	---
	Exhaust constituents	
Carbon dioxide (CO_2)(percent)	6.62	---
Oxygen (O_2)(percent)	11.9	---
Carbon monoxide (CO) (grams/hour)	2,530	325
Unburned hydrocarbons (grams/hour as CH_2)	407	135
Oxides of nitrogen (NO_x) (grams/hour as NO_2)**	18,865	1,700
Sulfur dioxide, calculated (grams/hour as SO_2, with assumed .25 percent sulfur fuel)	998	---

*From the Compilation of Air Pollutant Emissions Factors (Third Edition) EPA August 1977 (PB-275-525) section 3.1.

**Based on summation of NO (by nondispersive infrared method) and NO_2 (by nondispersive ultraviolet method). NO_x values based in chemiluminescent method will be approximately 11 percent lower than NO_x values stated above.

Assuming a typical exploratory drilling rig is working at 80 percent of the rated load capacity, in a typical drilling season, we have the following tons/year of constituents (Table 4):

Table 4. Typical Emissions of Drilling Rig Engines

(Source: Calculated from Table 3 using Guidelines for Air Quality Maintenance Planning and Analysis, v. 10 (revised), PB-274-087 Environmental Protection Agency, 1977)

Source	Emissions (tons/year)
Unburned hydrocarbons, as CH_2	4.5
Oxides of nitrogen, as NO_2	*216.0
Sulfur dioxide, as SO_2	11.4
Carbon monoxide (CO)	29

*NO_x concentrations will be required to comply with the national ambient air quality standard (annual arithmetic mean of 100 micrograms (ug) per cubic meter). It is not anticipated that in normal operations NO_x would exceed 250 tons/year, and therefore, NO_x need not be considered under the PSD review process. If this constituent were to exceed 250 tons/year, simple screening procedures indicate that the national ambient standard for NO_x would not be exceeded for values up to 1000 tons/year.

Under Montana air quality regulations, this engine setup could be considered a major emitting facility. Montana air quality regulations state that a source must produce 25 tons/year of a constituent to be considered a major emitting facility. However, it has not been the policy of the State of Montana to conduct reviews of drilling operations due to their temporal nature (personal conversations, State of Montana Department of Air Quality). Sulfur dioxide (SO_2) is the only pollutant produced by this engine setup covered by the federal air quality PSD standards, and at 11.4 tons/year, this pollutant is insignificant, and therefore, need not be considered under the PSD review process. Preliminary screening efforts indicate that the SO_2 Montana state ambient standards will be met (Montana Code Anotated Title 16, Chapter 8, Subchapter 8, 16.8.820).

Compressor stations along flowlines, if necessary in the event of extensive field development, would be permanent and probably emit in excess of 250 tons/year of NO_x, and as such, would be subject to a PSD and probable EIS review by the State of Montana. (Note: Final EIS on the Trailblazer Pipeline System, Federal Energy Regulatory Commission (FERC)/EIS-0018: Docket No. CP-79-80 et al.)

2. Exhaust From Service Vehicles

Emissions from vehicles would be at federally established standards. At their maximum during the drilling operation, the emissions would be difficult to distinguish from recreational traffic emissions in the area. Upon abandonment of the well, the emissions would be nonexistent; if production were

established, the emissions from infrequent service vehicles would be negligible.

3. Fugitive Dust

Fugitive dust is estimated to 4 tons/mile for exploratory drilling (based on extensive utilization for about 6 months). Watering of the roads or the use of dust-suppressing chemicals on the road, along with control of vehicular speed would reduce fugitive dust by 20 to 50 percent, and their use should be required (Note: Compilation of Air Pollutant Emission Factors (Third Edition), EPA, August 1977 (PB-275-525) Section 11.2.). Use of a campsite on drilling wellsites will reduce road use with a corresponding decrease in fugitive dust. If production is established, the fugitive dust generated by infrequent service and maintenance vehicles would be negligible.

4. Gases Encountered While Drilling

The following gases may be encountered during drilling, and could possibly be released into the atmosphere if a blowout were to occur. This release would be short-term. A blowout event is rare in the drilling industry and would require immediate attention. If it were to occur, it would be handled quickly. Minor amounts of these gases could be released during on-site production facilities upset conditions.

Carbon Dioxide (CO_2)

Carbon dioxide (CO_2) is usually considered inert and is commonly used to extinguish fires. At 1.5 times heavier than air, CO_2 will concentrate in low areas of quiet air. Humans cannot breathe air containing more than 10 percent of CO_2 without losing consciousness. Air containing 5 percent CO_2 will cause disorientation if breathed for 30 minutes or more, and air containing 10 percent CO_2 will cause disorientation in a few minutes.

The Threshold Limit Value of CO_2 is 5,000 ppm. Short-term exposure to 50,000 ppm (5 percent) is tolerable. This gas is colorless and odorless, and can be tolerated in relatively high concentrations.

Methane (CH_4)

Methane (CH_4) is the major component of natural gas, and is colorless, odorless, and combustible. The chief danger from methane is explosion.

Mixtures of CO_2, H_2S, and CH_4 will burn if the total H_2S and CH_4 content in any ratio is about 25 percent or greater. The products of combustion will include sulfur dioxide (SO_2), carbon dioxide (CO_2), and water and gas, and is 2.3 times heavier than air. CH_4 can be tolerated without gas masks at 10 ppm, but at 1,000 ppm it can be lethal.

Sulfur Dioxide (SO_2)

SO_2 is normally produced in oil field operations by the burning of H_2S (hydrogen sulfide gas). The Threshold Limit Value of SO_2 is 5 ppm. Short-term exposure to 10 ppm is tolerable. This gas is very irritating, and

no instruments are required to detect it. In the event SO_2 is encountered, a Draeger Multi-Gas Detector and detector tubes should be available to establish to SO_2 concentration if the necessity should arise. A self-contained breathing unit should be available to anyone measuring SO_2 downwind from a flare or other SO_2 source.

Hydrogen Sulfide (H_2S)

Hydrogen sulfide gas (H_2S) is a highly toxic gas that has a specific gravity of 1.192 at 60°F (air has a specific gravity of 1 at 60°F). It is a highly reactive gas and will corrode standard metals (the BLM requires the use of H_2S resistant alloys in the drilling and producing of hydrocarbons with associated H_2S). It burns with a blue flame and produces sulfur dioxide (SO_2), also a highly toxic gas. Hydrogen sulfide will disassociate itself from a natural gas stream in which it is mechanically mixed, and will tend to sink in the atmosphere due to its high specific gravity. The gas is, however, wind sensitive, and will be readily carried and diluted by winds. The toxicity to humans of H_2S is outlined in Table 5. The toxicity to big game animals is similar to that for humans. H_2S is more toxic to smaller animals. Low concentrations of H_2S have not been demonstrated to harm plant life.

Table 5. Effects of H_2S Gas on Humans

(Source: Adapted from API Recommended Practice No. 59 and various H_2S Safety Publications)

H_2S (ppm)[1]	%[2]	0 to 2 minutes	1 to 4 hours
.0015 to 1.0		Nuisance odor	Nuisance odor
1 to 20		Odor	Odor and mild throat irritation
20	.002	Upper 8-hour safe limit. Can smell. Safe for 5 hours exposure.	Eye stinging, throat irritation. May kill smell.
50	.005	Mild eye, throat irritation; kills smell in 15+ minutes.	Coughing, eye irritation, smell killed.
100	.01	Coughing, irritation of eyes, kills smell in 3 to 15 minutes. Burning of throat.	Coughing, sharp eye pain, throat pain.
200	.02	Kills smell quickly; severe throat and eye irritation; coughing.	Difficulty breathing, sharp eye pain, blurred vision. Cannot smell.

[1]Values over 500 ppm will result in extreme weakness and death.
[2]Present gas stream of the Blackleaf wells is 4% H_2S. Wells in the Wyoming Overthrust Belt produce 10-20% H_2S. Values over 30% H^2S are normally considered nonproducible due to the gases' effect on metals.

A concern to the residents and users of the area (as identified in the EIS Scoping Process) is the risk of a hydrogen sulfide (H_2S) blowout. However, the risk of a blowout occurring is minimal, as displayed in Table 6.

Table 6. Well Field Blowout Rates

Source	Blowouts/ Wells Drilled	Blowouts/ Producing Well-Year
Texas[1]	1 per 270	1 per 20,000
Alberta, Canada[2]	1 per 630	1 per 3,000
Gulf of Mexico[3]	1 per 250	Not given

Note: A blowout is defined as any uncontrolled release of gas to the atmosphere.

[1]Texas data for years 1977-1981 from David W. Layton, Lawrence Livermore National Laboratory, Livermore, California, October 4, 1982. Blowouts per wells drilled includes dry holes.

[2]Alberta, Canada, data for years 1970-1980 from David W. Layton, Lawrence Livermore Laboratory, California, October 4, 1982. Blowouts per wells drilled includes dry holes.

[3]Production of Natural Gas from the Lower Mobile Bay Field, Alabama, Final Environmental Impact Statement, U.S. Army Corps of Engineers, 1982. For Gulf of Mexico data.

However, in the unlikely event a blowout were to occur, an analysis has been done for this "worst possible case situation" (i.e., infrequent meteorological conditions that would result in high H_2S concentrations. This analysis assumes an extreme H_2S blowout situation at the Blackleaf Canyon mouth (near the present producing wells), coupled with worst case meteorological conditions. The actual gas stream consists of 4 percent H_2S,(40,000 ppm), 15 percent, CO_2, 84.6 high BTU gas and entrained gas condensates. (Correspondence with Williams Exploration and Mobil Oil.) However, since H_2S concentrations charge over time, a worst case maximum of 15 percent H_2S was assumed for this analysis. (For comparison purposes, wells in the southwest Wyoming Overthrust area produce 10 - 30 percent H_2S concentrations, 100,000 - 300,000 ppm.) The analysis indicates that H_2S concentrations passing by an individual at 2 miles downwind would be slightly less than 2 ppm. H_2S will tend to pool and to accumulate in low areas because of the high density of the gas. If a large uncontrolled blowout were to persist for 12 hours at this site during the worst-case meteorological conditions, H_2S concentrations could build to 15 ppm in the drainage bottoms of the study area at 2-mile distances downwind and to 50+ ppm at the wellsite.

In the event of such a major blowout, numerous federal regulatory agencies and company officials would be mobilized to evaluate the situation, and the well would be brought under control within several hours. Travel in the area would be restricted during this period. Thus, chances of a large uncontrolled blowout extending to 12 hours is extremely minimal.

If American Petroleum Institute (API) Guidelines were followed in the drilling of this well, the chances for a hydrogen sulfide breakout of any magnitude would be minimal. Precautions for drilling in H_2S environments as provided for in draft BLM Onshore Order No. 3, and API-recommended practices, should be required for the safety of the drilling rig crew and the general public. These procedures include placement of H_2S monitors at critical locations around the drill rig. These monitors would be set to trigger a visual and an audible alarm if H_2S is detected above a certain level (about 10 ppm). Additional measures include placement of respirators for drillers' use, increasing the mud pH so that any H_2S bound in the mud would disassociate into sulfide and hydrogen ions, and addition of H_2S scavengers to the mud that would form stable compounds when they come in contact with H_2S.

In the event H_2S is encountered, the well could be shut-in with the blowout preventers (BOP), and any additionally necessary safety precautions taken to ensure proper control of the H_2S. In the extremely unlikely event of an uncontrolled blowout, the rig would be flared in such a manner that the H_2S and natural gas would burn, forming a hot mixture of SO_2 that would readily volatilize and disperse, even in an inversion situation, due to its heat generated buoyancy. This would reduce safety concerns but still result in the release of a significent air pollutant.

5. Emissions From Producing Wellsites

Since these wells are primarily gas wells (with some entrained hydrocarbon liquids), producing well pollutant sources will be SO_2/H_2S from any flaring or venting, and minor H_2S/SO_2 emissions from the liquid storage facilities (tank batteries). Preliminary screening efforts indicate that flaring/venting would likely violate federal and state laws and should be disallowed except for testing purposes, and then only under an approved State of Montana Air Quality permit.

Nuisance odors from tank batteries could be reduced by the use of vapor recovery equipment.

6. Emissions From Hydrocarbon Processing Plants

If discovered gas had to be treated in order to transport it by pipeline, a hydrocarbon processing H_2S sweetening plant would be required (to remove the H_2S contaminant). All alternatives for the Blackleaf EIS will utilize the existing, permitted Gypsy Highview processing plant (at Bynum). As such, no plant analysis is required for this EIS; however, for comparison purposes, on an annual controlled operation basis, a facility would emit 4,000 tons of CO, 1,150 tons of NO_x, 150 tons of SO_2, 200 tons of hydrocarbons, and 24 tons of particulates. A major EIS, pursuant to State of Montana and Federal laws, would be required for any new plant or significant expansion of the existing Bynum plant.

7. GATHERING LINE RUPTURE

The risk of a pipeline rupture is extremely small, as shown in Table 7.

Table 7. Gas Pipeline Incident Rates

Source	Type of Product	Accident Rate (Incident/Mile/Year)
U.S. Dept. of Transportation (Office of Pipeline Safety)[1]	Natural Gas	0.0021 (gathering & transmission lines)
Texas Railroad Commission[2]	Natural Gas	0.00112 (fiscal 1981) 0.00108 (fiscal 1982) 0.0011 (fiscal 1982)
Production of Natural Gas Lower Mobile Bay Field, Alabama[3]	Natural Gas	0.0019
Energy Resources Conservation Board Alberta, Canada[4]	Sour Gas Natural Gas	0.00022 0.0041

[1]David Jossi, Information Systems Division, Research and Special Programs Administration, U.S. DOT, 1982.

[2]Sonny Hollub, Texas Railroad Commission, 1982.

[3]Production of Natural Gas From the Lower Mobile Bay Field, Alabama, FEIS, U.S. Army Corps of Engineers, May 1982.

[4]Wendy E. Roberts, Energy Resources Conservation Board, Calgary, Alberta, Canada, 1982.

In the event a rupture occurred, an air quality model was used to evaluate the consequences of a gathering line rupture. Because the effects of a gathering line rupture are relatively local and the gathering systems are not in the immediate vicinities of population areas, the consequences analysis could be made in a generic manner, that is, not tied to a specific location for a gathering line rupture. A sensitivity analysis revealed that the predicted concentrations are highly sensitive to the assumptions made about the initial rise of the released gas. The results are also sensitive to variations in block valve spacing (if any), pipeline diameters, pressures, and assumed H_2S content. However, in general the following conclusions can be drawn:

> Low wind speed stable atmospheric conditions result in the worst-case H_2S concentrations. These conditions are estimated to occur less than 10 percent of the time.

A rupture of a 4-inch pipeline is not likely to result in lethal H_2S doses. However, an individual located within about 0.1 mile (600 feet) might experience eye irritation or a loss of smell (discomfort).

A rupture of a 6-inch pipeline could result in lethal doses to persons located within a few hundred feet. People within about 0.5 mile of the rupture could also experience discomfort.

A 12-inch pipe, if ruptured, could cause a lethal dose to a distance of about 0.25 to 1 mile depending on the prevailing weather conditions, specific pipeline design, and H_2S content of the gas.

The Blackleaf Field is anticipated to have 4 to 6-inch lines which, as shown above, would have no fatal impact in the unlikely event a rupture occurred. This, coupled with the area's low level of visitors, would dictate that the addition of block valves is not necessary.

NOISE IMPACTS

General Characteristics

Background noise in the study area is generally very low (15 to 35 dbA), with most of the noise intrusions associated with hikers, wildlife, picnickers, horseback riders, cross-country skiers, snowmobiles, and wind-associated noises. Background noise/sound levels in the area were measured during July and August 1983. Measurements were made with a hand-held General Ration Noise Level Meter (Type 1563B, Serial Number C318988) in the Antelope Butte and Chicken Coulee areas. Average backlog noise levels were 30-40 dbA. The noise level would increase significantly in the immediate vicinity of the drilling wellsites and access roads. The source of the increased noise levels include heavy equipment during the 3 to 10-week construction period, diesel drilling engines and generators during drilling (4-6 months), traffic on access roads, and in the event of field development, compressor stations and pump jacks (gas wells produce little or no noise). Most of these noises would be short-term; however, if field development were to occur, and if compressor stations, conditioning plants, and pump jacks were installed, long-term noise impact zones around these facilities, and from maintenance traffic on access roads, would be felt by users of the area.

To determine the average envelope of sound impact around drilling wellsites, access roads, oil pumping facilities, compressor stations, and also to determine present ambient noise levels, two General Ratio Noise Level Meters were utilized by the author for the 1981 Cache Creek/Bear Trust EIS in Wyoming. A type 1565B (Serial No. C318988) hand-held meter and GR 1945 Community Noise Analyzer (Serial No. 138) were used. Sound measurements in dbAs were made at points around numerous drilling rigs, pump jacks, compressor stations, access roads, and at the proposed wellsites.

From those data, average envelopes of sound impacts were drawn around these components of exploratory drilling, production, and field development. (These average levels are intended only to give approximate areas of impact as individual location types, drilling rigs, and weather conditions will have an effect on sound levels.)

Presented in figures 5 through 8 are sound level averages for various exploratory and field components. These ranges are also plotted on a noise-level comparison chart in figure 9.

Conclusions

1. Drilling operations, and access road use (both during drilling and field maintenance) will result in noise impact zones.

2. Production operations would have minor noise impacts for oil production with artificial lift (pump jacks), to no impacts for the anticipated gas production. However, noise impact zones around access roads will remain, due to needed maintenance traffic.

IMPACT ANALYSIS BY ALTERNATIVE

Alternatives are thoroughly described in the body of the Blackleaf EIS. The alternative stated here is a brief synopsis of the alternative, followed by a description of the impacts that would occur under the alternative from the aspects of air quality and noise.

Alternative I - No Action

Under this alternative, no further drilling or development would be allowed. The two existing wells would be allowed to continue production, and two additional wells would be brought on-line (involving pipeline construction).

This scenario results in no new significant air quality or noise impacts and existing impacts, as described in this report, are well within federal and state standards, and have no significant adverse impact to the general air quality of the area. Flaring/venting except for test purposes should be disallowed. Nuisance odors at the existing sites could be eliminated by the installation of vapor recovery systems on the production facilities. Noise impact zones, caused by wellsite operation and maintenance, are displayed on the Alternative I map attached to this report.

Alternative II - Development

Under this alternative an additional eight to 15 wells would be drilled with a potential four to eight ultimately placed in producing status. No drilling time restrictions (drilling windows) or other special resource protection measures would be imposed.

Air Quality

Drilling operations will result in minor, short-term impacts to air quality as two to three drilling rigs operate in the area. Under this additional development scenario, production impacts to air quality would increase due to a multiplication of various minor fugitive gas amounts escaping at on-site well heads, treating and liquid storage facilities. These impacts would not approach federal or state standards (as demonstrated in the technical report on climate, air quality and noise); however, nuisance odors and minor H_2S and SO_2 concentrations could be eliminated by requiring vapor recovery systems on all liquid storage facilities and not allowing any flaring or

venting of gas.

No additional natural gas processing facility is necessary under this scenario. All gas will be transported to the existing, permitted facility at Bynum.

Hydrogen Sulfide (H_2S)/Safety

Hydrogen sulfide gas (H_2S) is a highly toxic gas that has a specific gravity of 1.192 at 60°F (air has a specific gravity of 1 at 60°F). It is a highly reactive gas and will corrode standard metals (the BLM requires the use of H_2S resistant alloys in the drilling and producing of hydrocarbons with associated H_2S). It burns with a blue flame and produces sulfur dioxide (SO_2), also a highly toxic gas. Hydrogen sulfide will disassociate itself from a natural gas stream in which it is mechanically mixed, and will tend to sink in the atmosphere due to its high specific gravity. The gas is, however, wind sensitive, and will be readily carried and diluted by winds. The toxicity to humans of H_2S is outlined in Table 5. The toxicity to big game animals is similar to that for humans. H_2S is more toxic to smaller animals. Low concentrations of H_2S have not been demonstrated to harm plant life.

Table 5. Effects of H_2S Gas on Humans

(Source: Adapted from API Recommended Practice No. 59 and various H_2S Safety Publications)

H_2S (ppm)[1]	0 to 2 minutes	1 to 4 hours
.0015 to .0075	Nuisance odor	Nuisance odor
1 to 20	Odor	Odor and mild throat irritation.
20	Upper 8-hour safe limit. Can smell. Safe for 5 hours exposure.	Eye stinging, throat irritation. May kill smell.
50	Mild eye, throat irritation; kills smell in 15+ minutes.	Coughing, eye irritation, smell killed.
100	Coughing, irritation of eyes, kills smell in 3 to 15 minutes. Burning of throat.	Coughing, sharp eye pain, throat pain.
200	Kills smell quickly; severe throat and eye irritation; coughing.	Difficulty breathing, sharp eye pain, blurred vision. Cannot smell.

[1]Values over 500 ppm will result in extreme weakness and death.

A concern to the residents and users of the area (as identified in the EIS Scoping Process) is the risk of a hydrogen sulfide (H_2S) blowout. However, the risk of a blowout occurring is minimal, as displayed in Table 6.

Table 6. Well Field Blowout Rates

Source	Blowouts/ Wells Drilled	Blowouts/ Producing Well-Year
Texas[1]	1 per 270	1 per 20,000
Alberta, Canada[2]	1 per 630	1 per 3,000
Gulf of Mexico[3]	1 per 250	Not given

Note: A blowout is defined as any uncontrolled release of gas to the atmosphere.

[1]Texas data for years 1977-1981 from David W. Layton, Lawrence Livermore National Laboratory, Livermore, California, October 4, 1982. Blowouts per wells drilled includes dry holes.

[2]Alberta, Canada, data for years 1970-1980 from David W. Layton, Lawrence Livermore Laboratory, California, October 4, 1982. Blowouts per wells drilled includes dry holes.

[3]Production of Natural Gas from the Lower Mobile Bay Field, Alabama, Final Environmental Impact Statement, U.S. Army Corps of Engineers, 1982. For Gulf of Mexico data.

However, in the unlikely event a blowout were to occur, an analysis has been done for this "worst possible case situation" (i.e., infrequent meteorological conditions that would result in high H_2S concentrations. This analysis assumes an extreme H_2S blowout situation at the Blackleaf Canyon mouth (near the present producing wells), coupled with worst case meteorological conditions. The gas stream consists of 4 percent H_2S, 15 percent, CO_2, 84.6 percent high BTU gas and entrained gas condensates. (Correspondence with Williams Exploration and Mobil Oil.) However, since H_2S concentrations change over time, a worst case maximum of 15 percent H_2S was assumed for this analysis. (For comparison purposes, wells in the southwest Wyoming Overthrust area produce 10 - 30 percent H_2S concentrations.) The analysis indicates that H_2S concentrations passing by an individual at 2 miles downwind would be slightly less than 2 ppm. H_2S will tend to pool and to accumulate in low areas because of the high density of the gas. If a large uncontrolled blowout were to persist for 12 hours at this site during the worst-case meteorological conditions, H_2S concentrations could build to 15 ppm in the drainage bottoms of the study area at 2-mile distances downwind and to 50+ ppm at the wellsite.

In the event of such a major blowout, numerous federal regulatory agencies and company officials would be mobilized to evaluate the situation, and the well would be brought under control within several hours. Travel in the area would be restricted during this period. Thus, chances of a large uncontrolled blowout extending to 12 hours is extremely minimal.

If American Petroleum Institute (API) Guidelines were followed in the drilling of this well, the chances for a hydrogen sulfide breakout of any magnitude would be minimal. Precautions for drilling in H_2S environments as provided for in draft BLM Onshore Order No. 3, and API-recommended practices, should be required for the safety of the drilling rig crew and the general public. These procedures include placement of H_2S monitors at critical locations around the drill rig. These monitors would be set to trigger a visual and an audible alarm if H_2S is detected above a certain level (about 10 ppm). Additional measures include placement of respirators for drillers' use, increasing the mud pH so that any H_2S bound in the mud would disassociate into sulfide and hydrogen ions, and addition of H_2S scavengers to the mud that would form stable compounds when they come in contact with H_2S.

In the event H_2S is encountered, the well could be shut-in with the blowout preventers (BOP), and any additionally necessary safety precautions taken to ensure proper control of the H_2S. In the extremely unlikely event of an uncontrolled blowout, the rig would be flared in such a manner that the H_2S and natural gas would burn, forming a hot mixture of SO_2 that would readily volatilize and disperse, even in an inversion situation, due to its heat generated buoyancy. This would reduce safety concerns but still result in the release of a significant air pollutant.

If discovered gas had to be treated in order to transport it by pipeline, a hydrocarbon processing H_2S sweetening plant would be required (to remove the H_2S contaminant). All alternatives for the Blackleaf EIS will utilize the existing, permitted Gypsy Highview processing plant (at Bynum). As such, no plant analysis is required for this EIS; however, for comparison purposes, on an annual controlled operation basis, a facility would emit 4,000 tons of CO, 1,150 tons of NO_x, 150 tons of SO_2, 200 tons of hydrocarbons, and 24 tons of particulates. A major EIS, pursuant to State of Montana and Federal laws, would be required for any new plant or significant expansion of the existing Bynum plant.

Any gas flaring or venting would likely violate Federal and Montana State ambiant air quality standards for H_2S (Montana Code Annotated Title 16, Chapter 8, Subchapter 8, 16.8.814) and SO_2 (Montana Code Annotated Title 16, Chapter 8, Subchapter 8, 16.8.820). Therefore, such flaring or venting should be disallowed except for test periods. Montana State Air Quality permits would be required for any such tests.

Hydrogen Sulfide emissions could also occur from pipeline ruptures; however, the risk of a pipeline rupture is extremely small, as shown in Table 7.

Table 7. Gas Pipeline Incident Rates

Source	Type of Product	Accident Rate (Incident/Mile/Year)
U.S. Dept. of Transportation (Office of Pipeline Safety)[1]	Natural Gas	0.0021 (gathering & transmission lines)
Texas Railroad Commission[2]	Natural Gas	0.00112 (fiscal 1981) 0.00108 (fiscal 1982) 0.0011 (fiscal 1982)
Production of Natural Gas Lower Mobile Bay Field, Alabama[3]	Natural Gas	0.0019
Energy Resources Conservation Board Alberta, Canada[4]	Sour Gas Natural Gas	0.00022 0.0041

[1]David Jossi, Information Systems Division, Research and Special Programs Administration, U.S. DOT, 1982.

[2]Sonny Hollub, Texas Railroad Commission, 1982.

[3]Production of Natural Gas From the Lower Mobile Bay Field, Alabama, FEIS, U.S. Army Corps of Engineers, May 1982.

[4]Wendy E. Roberts, Energy Resources Conservation Board, Calgary, Alberta, Canada, 1982.

In the event a rupture occurred, an air quality model was used to evaluate the consequences of a gathering line rupture. Because the effects of a gathering line rupture are relatively local and the gathering systems are not in the immediate vicinities of population areas, the consequences analysis could be made in a generic manner, that is, not tied to a specific location for a gathering line rupture. A sensitivity analysis revealed that the predicted concentrations are highly sensitive to the assumptions made about the initial rise of the released gas. The results are also sensitive to variations in block valve spacing (if any), pipeline diameters, pressures, and assumed H_2S content. However, in general the following conclusions can be drawn:

> Low wind speed stable atmospheric conditions result in the worst-case H_2S concentrations. These conditions are estimated to occur less than 10 percent of the time.
>
> A rupture of a 4-inch pipeline is not likely to result in lethal H_2S doses. However, an individual located within about 0.1 mile (600 feet) might experience eye irritation or a loss of smell (discomfort).

A rupture of a 6-inch pipeline could result in lethal doses to persons located within a few hundred feet. People within about 0.5 mile of the rupture could also experience discomfort.

A 12-inch pipe, if ruptured, could cause a lethal dose to a distance of about 0.25 to 1 mile depending on the prevailing weather conditions, specific pipeline design, and H_2S content of the gas.

The Blackleaf Field is anticipated to have 4 to 6-inch lines which, as shown above, would have no fatal impact in the unlikely event a rupture occurred. This, coupled with the area's low level of visitors, would dictate that the addition of block valves is not necessary.

Noise

Under this unregulated drilling option, year-round noise impacts would occur. A muffler system capable of average 30 dbA spectrum reduction of noise could be required on all drilling rigs to narrow the noise impact areas. The Alternative II noise impact areas are displayed on the Alternative II map attached to this report.

Production noise at the wellsites is insignificant and no impact would occur; however, maintenance visitation to the wellsite would cause noise impacts. Production tests flares will result in intermittent high noise (1 - 12 hour tests) over a 1 week period. These tests will have significant (70 - 90 DbA) noise levels associated with them. These noise impact areas are displayed on the alternative maps attached to this report.

Alternative III - Maximum Resource Protection

Under this scenario, two to four wells would be drilled in restrictive time zones with a potential for possibly two additional wells ultimately placed on production.

Air Quality

Drilling operations will result in minor, short-term impacts to air quality as a drilling rig operates in the area. Under this development scenario, production impacts to air quality would increase due to a multiplication of various minor fugitive gas amounts escaping at on-site well heads, treating and liquid storage facilities. These impacts would not approach federal or state standards (as demonstrated in the technical report on climate, air quality and noise); however, nuisance odors and minor H_2S, SO_2 concentrations could be eliminated by requiring vapor recovery systems on all liquid storage facilities and not allowing any flaring or venting of gas.

Hydrogen Sulfide safety-related concerns would be similar to those discussed in Alternative II, diminished to some degree due to the lessening of the total number of wells.

Noise

Drilling noise impacts would be seasonal under this scenario due to seasonal

drilling restrictions.

Production noise at the wellsites is insignificant and no impacts would occur; however, maintenance visitation to the wellsite would cause noise impacts. Production tests flares will result in intermittent (1 - 12 hour tests) high noise over a 1-week period. These tests will have significant (70 - 90 DbA) noise levels associated with them. These noise impact areas are displayed on the alternative maps attached to this report.

Alternative IV - Development with restrictions

The scenario under this alternative is similar to that under Alternative II, with the addition of drilling timing restrictions (windows) and potential production timing restrictions (windows).

Air Quality

Drilling operations will result in minor, short-term impacts to air quality as drilling rigs operate in the area. Under this development scenario, impacts to air quality would increase due to a multiplication of various minor fugitive gas amounts escaping at on-site well heads, treating and liquid storage facilities. These impacts would not approach federal or state standards (as demonstrated in the technical report on climate, air quality and noise); however, nuisance odors and minor H_2S, SO_2 concentrations could be reduced by requiring vapor recovery systems on all liquid storage facilities and not allowing any flaring or venting of gas.

No additional natural gas processing facility is necessary under any scenario. All gas will be transported to the existing, permitted facility at Bynum.

Hydrogen Sulfide safety-related concerns would be similar to those discussed in Alternative II, diminished to some degree due to the lessening to the total number of wells.

Noise

Drilling noise impacts would be seasonal under this scenario due to seasonal drilling restrictions.

Production noise at wellsite is insignificant and no impacts would occur; however, maintenance visitation to the wellsite would cause noise impacts. These noise impacts would be eliminated if production were required to be seasonal. Production tests flares will result in intermittent (1 - 12 hour tests) high noise over a 1 week period. These tests will have significant (70 - 90 DbA) noise levels associated with them. These noise impact areas are displayed on the alternative maps attached to this report.

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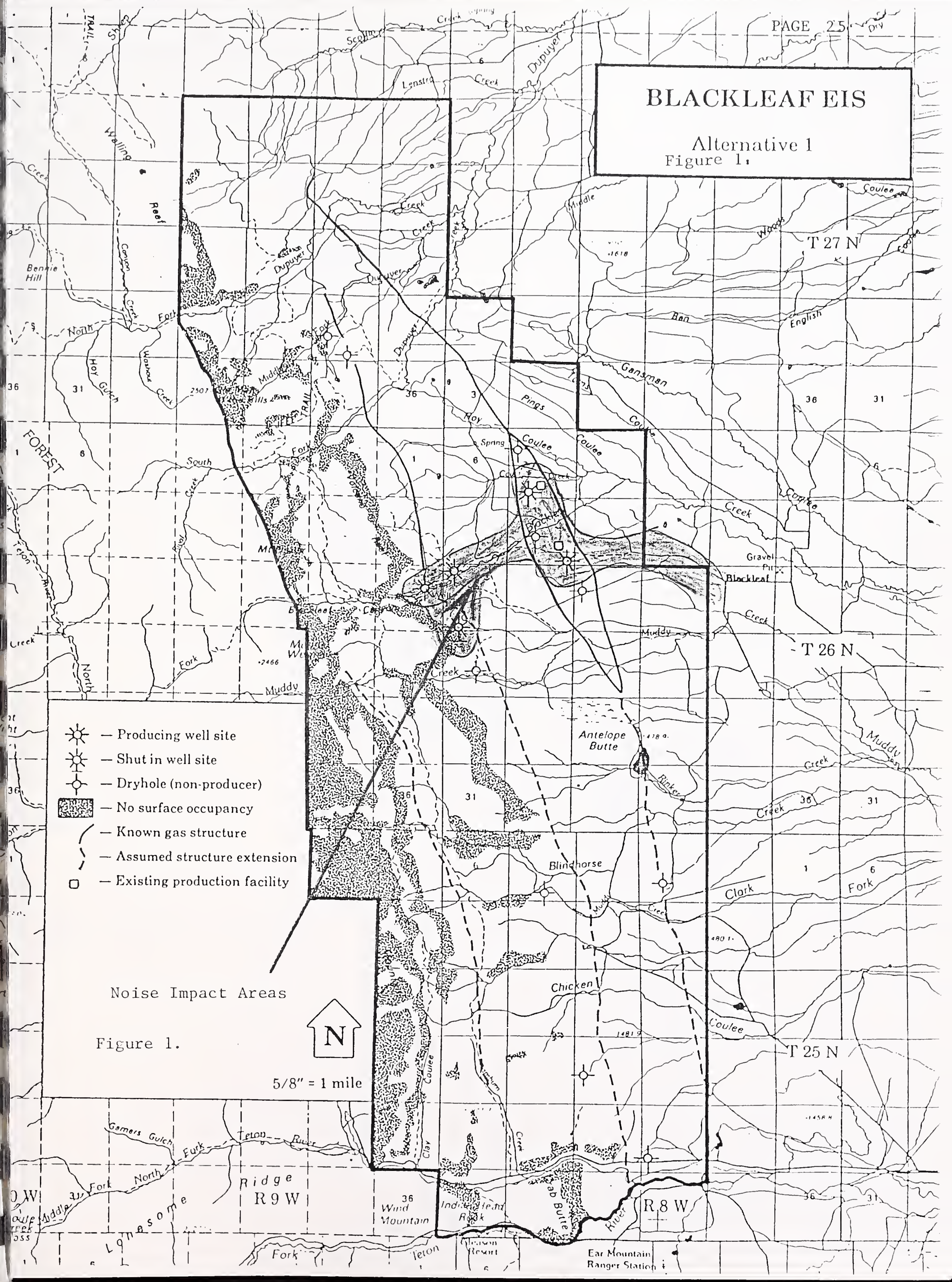
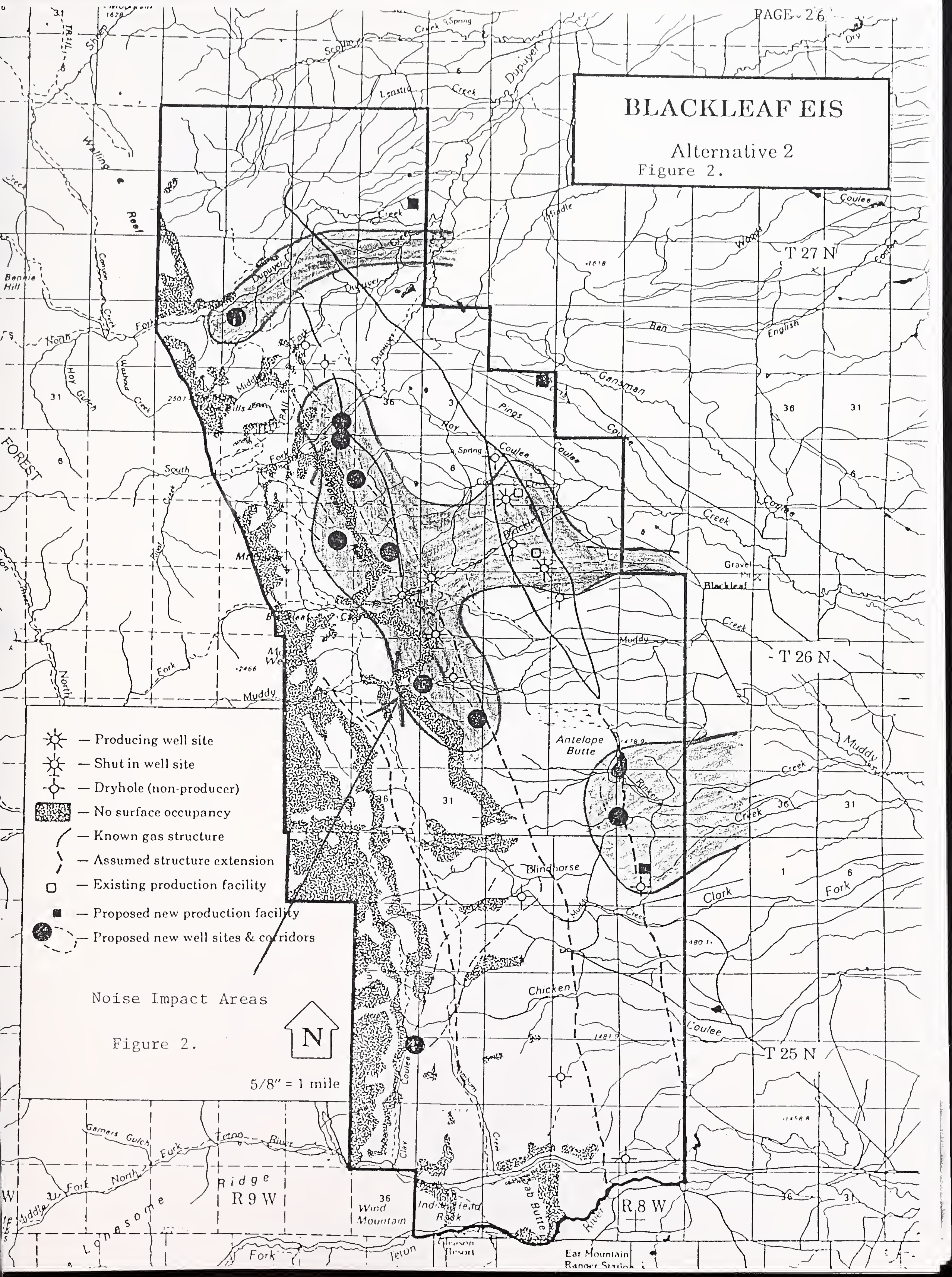
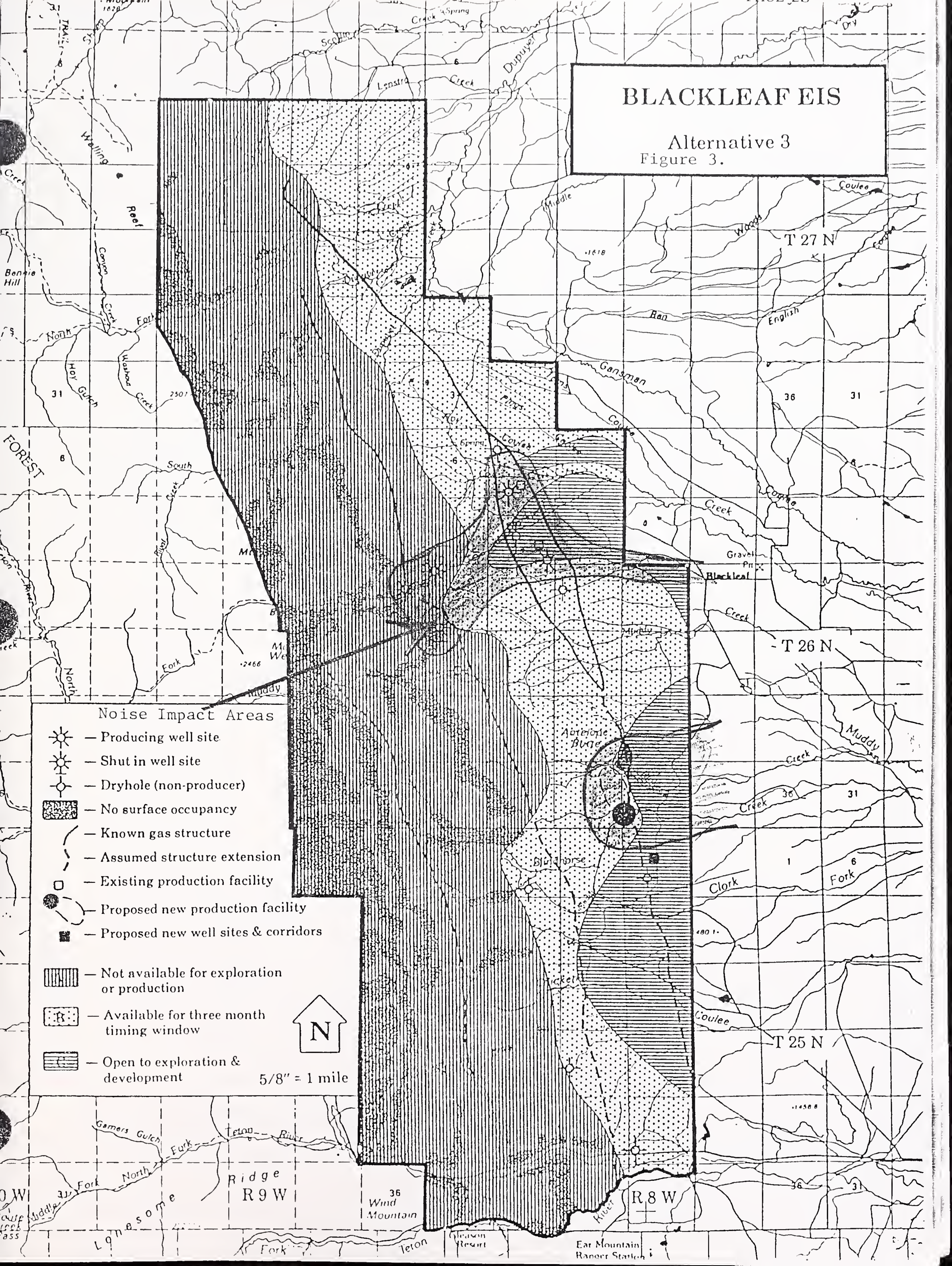
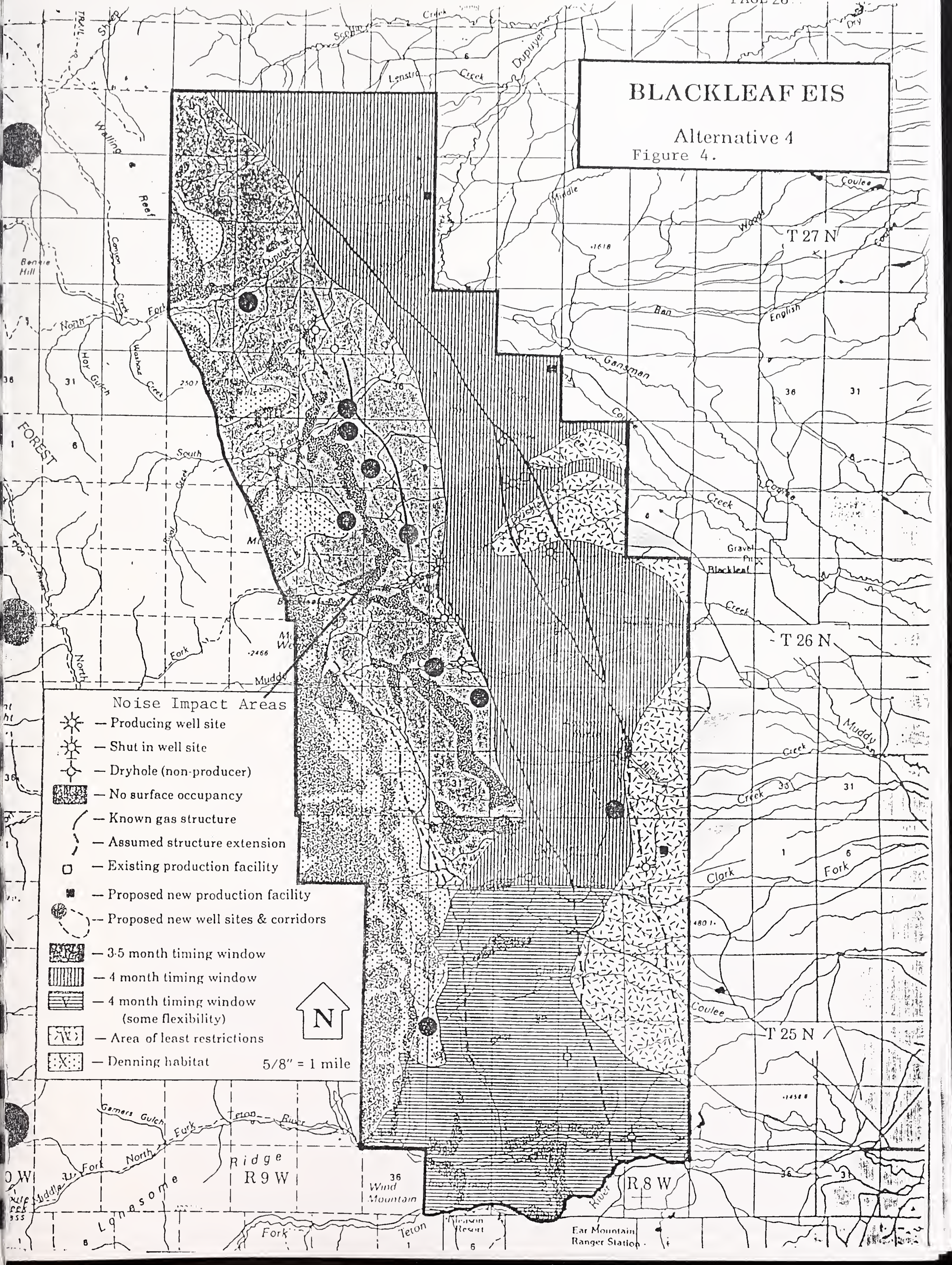
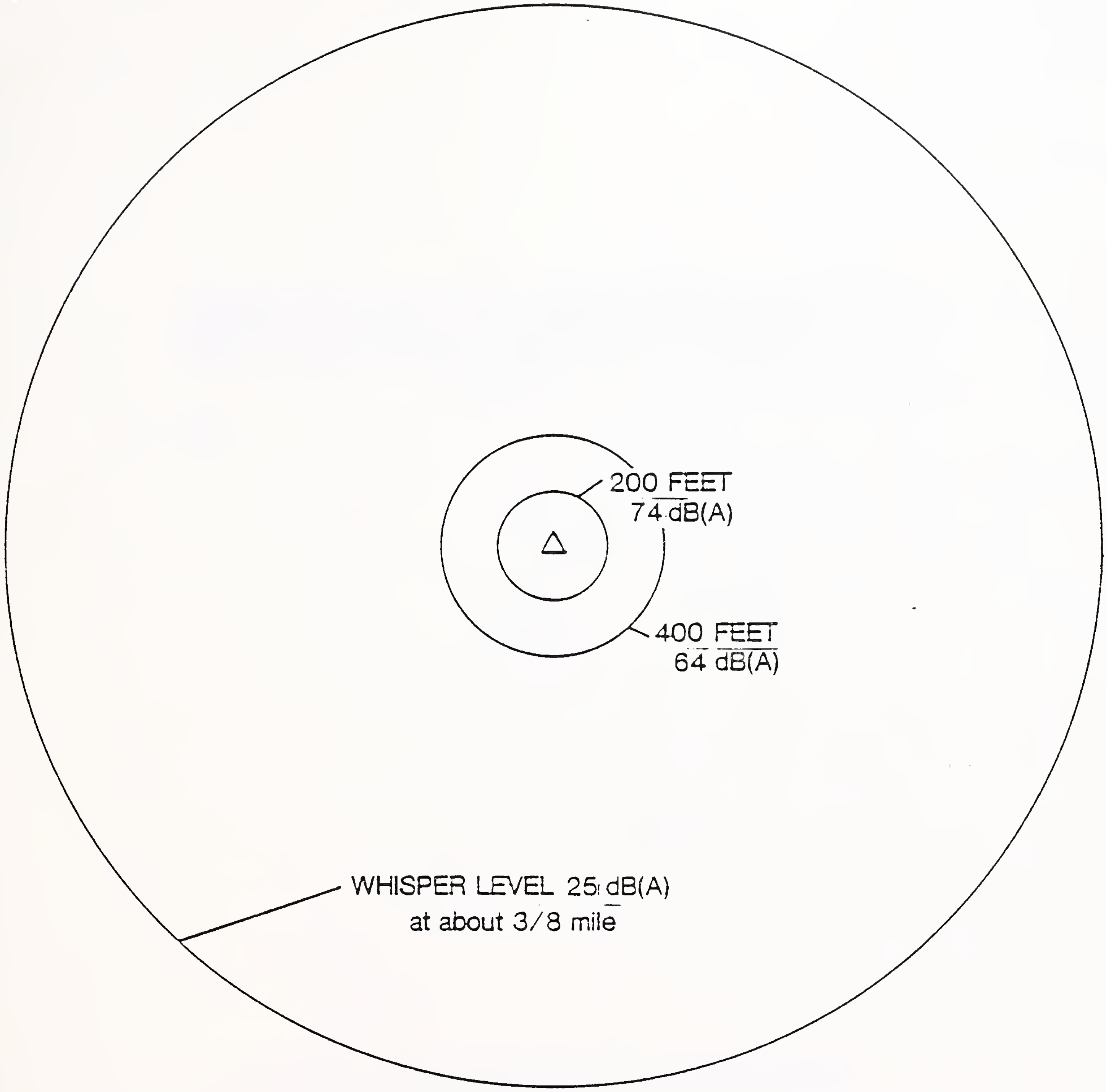

BLACKLEAF EIS
Alternative 1
Figure 1.
— Producing well site
— Shut in well site
— Dryhole (non-producer)
— No surface occupancy
— Known gas structure
— Assumed structure extension
— Existing production facility
Noise Impact Areas
Figure 1.
N
5/8" = 1 mile
T 27 N
T 26 N
T 25 N
R 9 W
R 8 W
Antelope Butte
Blindhorse
Chicken
Coulee
Clark
Fork
Muddy
Creek
Blackleaf
Gravel Pit
Dupuyer
Gansman
Pings
Coulee
Roy
Spring
Woods
English
Ban
Rinker
FOREST
South
North
Teton
River
Walling
Reef
Canyon
Bennie Hill
Hoy Gulch
Washoe Creek
Lonesome
Ridge
Wind Mountain
Indian Head Rock
Crab Butte
Gleason Resort
Ear Mountain Ranger Station
Lenstra
Creek


BLACKLEAF EIS
Alternative 2
Figure 2.
Producing well site
Shut in well site
Dryhole (non-producer)
No surface occupancy
Known gas structure
Assumed structure extension
Existing production facility
Proposed new production facility
Proposed new well sites & corridors
Noise Impact Areas
Figure 2.
N
5/8" = 1 mile
T 27 N
T 26 N
T 25 N
R 9 W
R 8 W
Dupuyer
Creek
Blackleaf
Muddy
Antelope Butte
Blindhorse
Clark
Fork
Chicken
Coulee
Gansman
English
Teton
River
Ear Mountain Ranger Station
Wind Mountain
FOREST
Bennie Hill


BLACKLEAF EIS
Alternative 3
Figure 3.
Noise Impact Areas
— Producing well site
— Shut in well site
— Dryhole (non-producer)
— No surface occupancy
— Known gas structure
— Assumed structure extension
— Existing production facility
— Proposed new production facility
— Proposed new well sites & corridors
— Not available for exploration or production
B — Available for three month timing window
C — Open to exploration & development
N
5/8" = 1 mile
T 27 N
T 26 N
T 25 N
R 9 W
R 8 W
Blackleaf
Antelope Butte
Gravel Pit
Dupuyer Creek
Muddy Creek
Clark Fork
Gansman Coulee
Teton River
Wind Mountain
Ear Mountain Ranger Station



BLACKLEAF EIS
Alternative 4
Figure 4.
Noise Impact Areas
— Producing well site
— Shut in well site
— Dryhole (non-producer)
— No surface occupancy
— Known gas structure
— Assumed structure extension
— Existing production facility
— Proposed new production facility
— Proposed new well sites & corridors
— 3-5 month timing window
— 4 month timing window
— 4 month timing window (some flexibility)
— Area of least restrictions
— Denning habitat
5/8" = 1 mile
N
T 27 N
T 26 N
T 25 N
R 9 W
R 8 W
FOREST
Walling
Reef
Dupuyer
Lenstra
Creek
Middle
Woods
English
Gansman
Coulee
Blackleaf
Gravel Pit
Muddy
Clark
Fork
Teton
River
Ridge
Wind Mountain
Ear Mountain Ranger Station
Lonesome
North
South
Hoy Gulch
Bennie Hill



MITIGATION: Require the use of Diesel-Electric type drilling rigs which produce constant noise levels over long periods of time as opposed to Direct Drive diesel engines which produce highly variable noise levels. Require the use of mufflers on drilling rig engines that would not adversly effect engine effeciency. These mufflers are capable of up to 30db reduction in noise levels at certain frequencies.

Figure 5.—Average envelope of noise levels aroung a drilling rig.

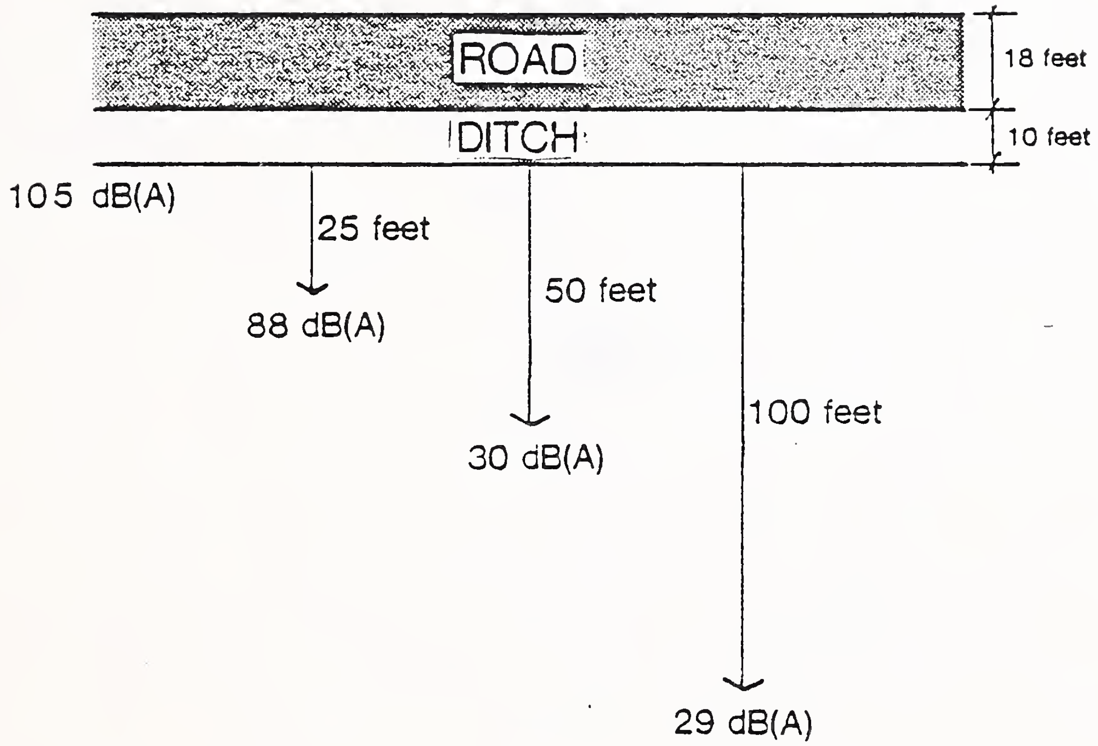
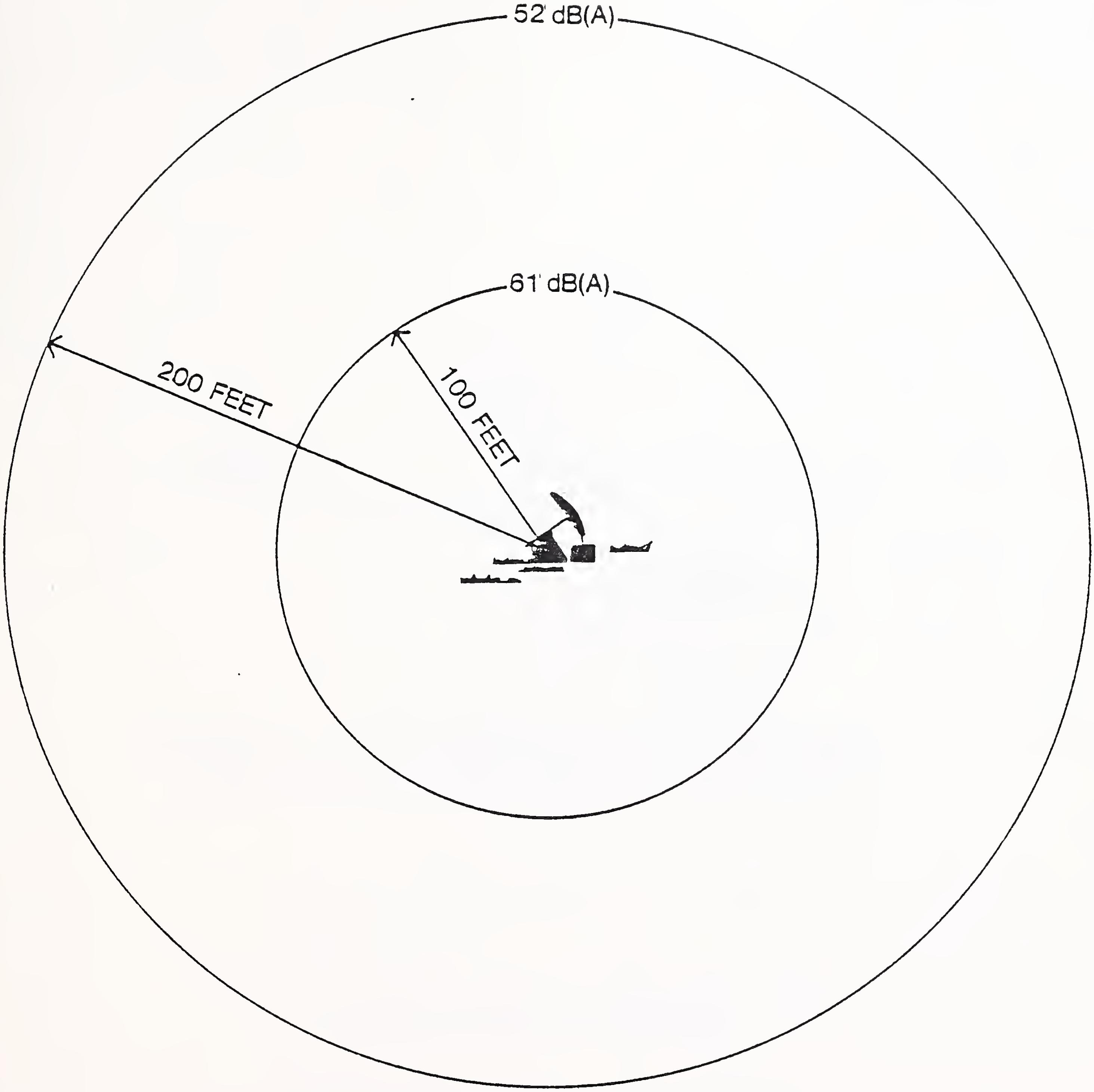
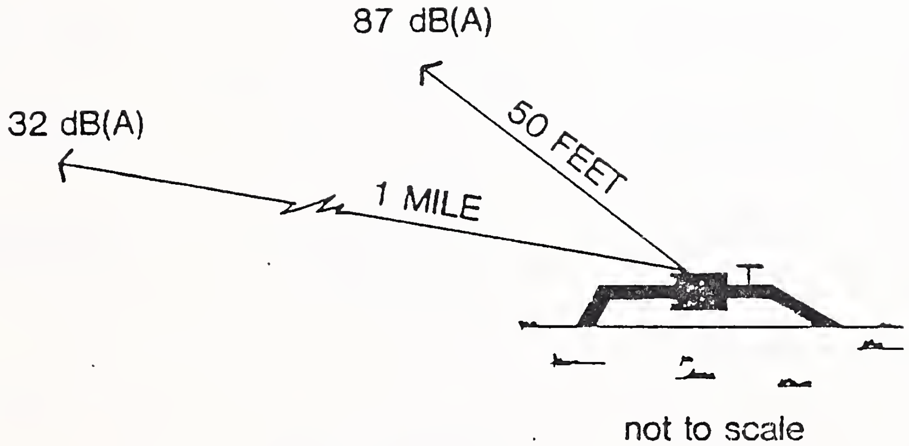


Figure 6.--Average envelope of noise levels around oil field access roads.



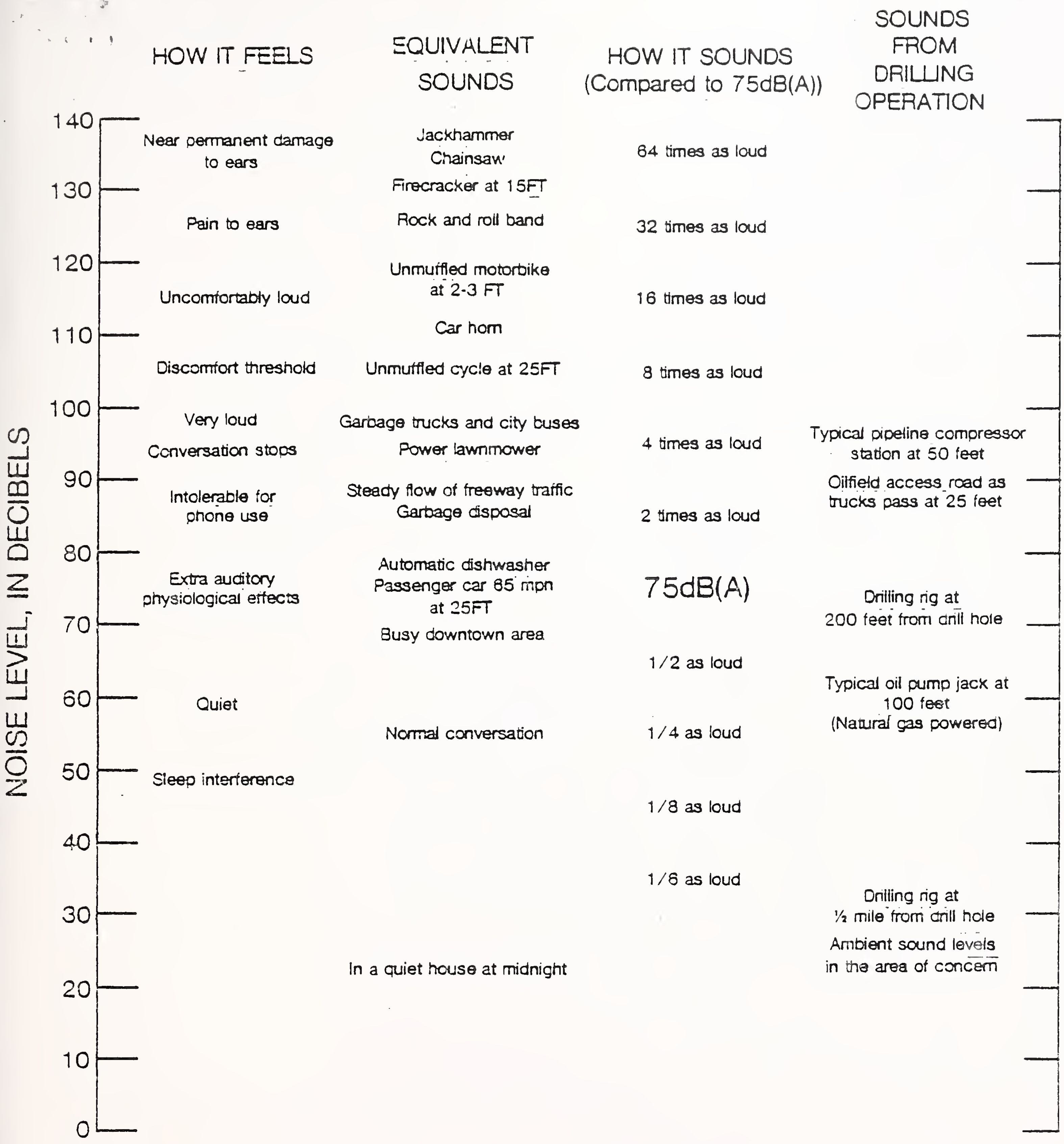
MITIGATION: Require use of electrically driven pumps that have no noise impact.

Figure 7.—Average envelope of noise impacts around a natural gas driven pump jack.



MITIGATION: Locate compressors away from residences and critical wildlife areas. Use of mufflers to reduce noise levels

Figure 8.--Average envelope of noise impacts around a typical pipeline compressor unit.



Modified from the Federal Energy Regulatory Commission (FERC)
Final EIS on Trailblazer Pipeline System FERC/EIS-0018 Docket No. CP79-80 et al

Figure 9.—Noise level comparison chart.